LIMIT FEEDING VS FULL FEEDING HIGH CONCENTRATE DIETS TO EARLY WEANED CALVES - EFFECTS ON PERFORMANCE TO SLAUGHTER

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Story in Brief

Fifty-eight fall-born calves were allotted on January 18 to four treatment groups consisting of: 1) early weaning and limit-feeding a 90% concentrate ration to gain 1.0 lb/day; 2) same as Treatment 1 except fed to gain 1.5 lb/day; 3) same as 1 except full-fed the 90% concentrate diet; or 4) calves remained with their dams until normal weaning on May 1, 1989. On May 1, all calves were placed on full feed until slaughter at .5 inch backfat estimated by ultrasound scan. Limit-fed calves gained at or slightly above projected gains, while full-fed calves gained 3.86 lb/day during the same period. On an as fed basis, lb feed/lb gain during the limit feeding period were 5.7 and 4.4 for limit-fed groups and 3.7 for the full-fed group. During finishing calves previously limit-fed at 1.0 lb/day tended to gain faster than calves limit-fed at 1.5 lb (3.23 vs 3.06 lb/day). Full-fed calves made the lowest gains during finishing (2.45 lb/day) and also had the lowest feed intake throughout the finishing phase. Finishing gain and feed intake were similar for normally weaned calves and calves previously limit-fed. Full-fed calves tended to be the youngest at slaughter although slaughter weights were similar for all treatments. Marbling score was not improved by feeding concentrate at an early age.

(Key Words: Beef Cattle, Early Weaning, Limit Feeding, Marbling.)

Introduction

Early weaning can be a useful tool during conditions when forage for the cow herd is inadequate, cows are too thin to breed, or other conditions in which the amount of purchased feed required to maintain both cow and calf can be more efficiently fed directly to the calf. The most commonly used

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early weaning rations contain relatively high levels of roughage to limit daily gains during the growing period to normal weaning age. Recent research has shown that a more efficient approach to growing young cattle at moderate rates of gain may be to feed high concentrate rations at daily amounts necessary to achieve target gains. A computer program can generate daily feeding rates based on calf sex, weight and desired rate of gain. Preliminary research at other universities has also suggested that feeding high concentrate diets to young calves may improve marbling at slaughter. The severe drought of 1988 created the need to early wean a group of fall-born calves at the Range Cow Research Center. The objectives of this study were to evaluate performance of early weaned calves limit-fed or full-fed high concentrate diets to normal weaning age and to evaluate subsequent finishing performance and carcass characteristics.

Materials and Methods

Fifty-eight calves born between September 1 and November 7, 1988 were weighed on January 18, 1989 after 4 h withdrawal from their dams. Calves were then allotted to four treatment groups based on breed, sex and weight. Treatments were: 1) early weaned and limit-fed a 90% concentrate ration to gain 1.0 lb/day; 2) same as Treatment 1 except fed to gain 1.5 lb/day; 3) same as 1 except full-fed the 90% concentrate diet; or 4) calves remained with their dams until normal weaning on May 1, 1989. Treatment 4 calves received 2 lb/day of salt-limited creep (67% rolled corn - 33% soybean meal) while on pasture.

All calves were vaccinated with 7-way blackleg (Ultra-bac 7), intranasal IBR-PI3 (Nasamune-IP), a live culture Pasteurella vaccine (Respirvac - Beecham Labs), and implanted with Synovex C. Early weaned calves were maintained in one pen for a 26-day weaning period and fed a complete mixed ration (Table 1). On February 13, calves were sorted to treatments and fed the 90% concentrate ration (Table 1) at designated levels. Feeding rates for limit-fed treatments were changed at 14-day intervals as weight increased. Steers were fed separately from heifers during the limit-feeding period. Average feeding levels for limit- and full-fed calves are shown in Table 2.

On May 1, calves from Treatment 4 were weaned and fed the weaning ration (Table 1) for 12 days after which they were switched to the final finishing ration which was fed to all treatments until slaughter (Table 3). Calves from Treatments 2 and 3 were adjusted to full feed by increasing daily feed by 1 lb/day until some feed was left. At this point, all calves were fed from self-feeders. On May 12, all calves were revaccinated with 7-way blackleg and IBR-PI3 (Norden Resbo 3). Heifers and steers were fed together during the finishing phase. Fat over the 12th rib was estimated every 14 days during the finishing phase using ultrasound. Calves were

Table 1. Weaning ration used for early and normally weaned calves (as fed basis).

Ingredient[a]	Ration		
	Weaning	Limit feeding	Finishing
Rolled corn	47.5	66.5	71.9
Cottonseed hulls	25.0	6.0	5.9
Cane molasses	3.5	3.5	4.1
Alfalfa, suncured	5.0	5.0	4.9
Soybean meal	14.8	14.8	9.71
Calcium carbonate	1.71	1.71	1.26
Cottonseed meal	2.02	2.02	1.94
Dicalcium phosphate	.15	.15	---
Rumensin 60	.02	.02	.02
Salt	.30	.30	.30
Trace mineral premix	.01	.01	.01
Vit E (222800)	.01	.01	.01
Vit A (30,000)	.01	.01	.01
Tylan 40	.01	.01	.01
Calculated analysis, %			
Crude protein	13.9	14.6	12.7
Calcium	.78	.61	.61
Phosphorus	.29	.29	.29

[a] Soybean meal, cottonseed meal, minerals, vitamins and additives were pelleted (3/16 in) before mixing with other ingredients.

slaughtered at a local commercial facility when estimated backfat reached .5 in. Except for initial weight on January 18, all calf weights were taken without withdrawal from feed or water and were adjusted for 4% shrink. Carcass measurements were taken 24 h following slaughter.

Data were analyzed using general linear models procedure. The model included treatment, breed and sex of calf, age of dam, calf birthweight and birthdate.

Results and Discussion

No sickness was observed during the weaning period from January 18 to February 13. Early weaned calves' gains averaged 1.77 lb/day (Table 2)

Table 2. Gains and feed intakes of early and normally weaned calves through slaughter (least squares means).

	Treatments			
	Early weaned			
	1.0 lb/day	1.5 lb/day	Full feed	Normal weaned
No. of calves	12	14	15	14
Calf weight, lb				
Jan 18	222	229	211	231
Feb 13	269	268	263	245
May 1	352[a]	415[b]	560[c]	402[b]
slaughter	838	852	854	843
Daily gain, lb				
Jan 18 to Feb 13	1.81[ab]	1.49[a]	2.00[b]	.57[c]
Feb 13 to May 1	1.08[a]	1.91[b]	3.86[c]	2.04[b]
May 1 to slaughter	3.23[bc]	3.06[b]	2.45[a]	3.12[b]
Jan 18 to slaughter	2.43[b]	2.53[b]	2.90[a]	2.50[b]
Feed:gain, as fed				
Feb 13 to May 1	5.7	4.4	3.7	-----
May 1 to slaughter	5.3	5.80	5.7	5.9
Feed intake, lb/day				
Feb 13 to May 1	6.2	8.25	14.5	-----
May 1 to slaughter	16.9	18.0	14.9	18.3
Days from May 1 to slaughter	153	144	118	142
Age at slaughter/days	379	370	343	367

[a,b,c] Means in the same row with different superscripts differ ($P < .05$).

Table 3. Carcass characteristics of early and normally weaned calves (least squares means).

	Treatments			
	Early weaned			
	1.0 lb/day	1.5 lb/day	Full feed	Normal weaned
Hot carcass weight	551	552	567	542
Dressing, %	65.9	64.7	66.3	64.2
Quality grade[a]	340	326	342	352
Ribeye area, in	11.3	11.4	11.6	10.7
Marbling score[b]	339	326	338	358
Fat thickness, in	.50	.45	.50	.47
KHP, %	1.89	1.73	1.72	1.95
Yield grade	2.62	2.42	2.54	2.71
Maturity[c]				
lean	152[a]	144[ab]	133[b]	141[b]
skeletal	138	135	129	131
overall	145	139	131	136

[a] 200 = standard, 300 = select, 400 = choice.
[b] 200 = traces, 300 = slight, 400 = small.
[c] 100 = A maturity.

during the 26-day weaning period. Calves that remained on pasture with their dams gained only .57 lb/day ($P < .01$) during the same period. This is consistent with our previous Oklahoma State University studies with early weaned calves and demonstrates that early weaned calves can adapt quickly to mixed rations.

During the limit-feeding period, it was necessary to remove one calf from Treatment 1 on April 28 because of chronic bloating. An additional calf from Treatment 1 was removed during the finishing phase of the study because of poor performance. It was not believed that the poor performance of this calf was related to the study. Only one calf was treated for respiratory infection throughout the study. A number of calves were treated for footrot in May and June, probably because of heavy rainfall and muddy lot conditions.

The small amount of the high concentrate diet used for 1.0 lb/day gain during limit feeding (Table 2) was insufficient to maintain comfort among the calves. Calves from this group consumed their feed (avg of 6.2 lb) within 5

min and were continuously hungry. Calves consumed dirt and attempted to paw out hay residues in the pen. Although 1.0 lb/day is not a low rate of gain for cattle on a full feed of roughage, there may be a minimum daily amount of feed to provide satiety. The amount of feed for a projected 1.5 lb/day gain was consumed within 1 to 2 h. Calves from this group appeared comfortable.

Calves in Treatment 1 were very close to their projected 1.0 lb/day gain (1.08 lb/day, Table 2) while Treatment 2 calves gained about .4 lb/day faster than projected. Full-fed calves gain 3.86 lb/day during the same period. This rate of gain demonstrates that even light-weight, young calves are capable of rapid gains when fed high concentrate diets. Calves that remained on their dams, gained 2.04 lb/day, very similar to limit-fed calves from Treatment 2. Although it was not possible to analyze individual feed intake because calves from each treatment were fed together, feed intake and feed efficiency data are shown in Table 2. Young, light weight calves fed high concentrate diets are very efficient. On an as fed basis (diet dry matter approximately 89%), lb feed/lb gain during the limit feeding period were 5.7 and 4.4 for Treatments 1 and 2 and 3.7 for the full-fed group.

Because one objective of this study was to evaluate the effects of early concentrate feeding on ability to deposit marbling at early ages, all calves were switched to full feeding at approximately 7 months of age on May 1. Light weights at 7 months of age and a sex distribution of 2 heifers for each steer, resulted in slaughter weights that were lighter than desirable for the beef trade. For commercial purposes, calves should have remained on growing diets until they reached heavier weights.

Gains of calves during the finishing phase were generally inverse to gains during growing or nursing. Calves from Treatment 1 tended to gain faster than calves from Treatment 2 (3.23 vs 3.06 lb/day). Full-fed calves from Treatment 3 made the lowest gains during finishing and also had the lowest feed intake throughout the finishing phase. Calves from Treatment 4 gained at a similar rate during finishing as calves from Treatment 2. Similar gain and feed intake for Treatments 2 and 4 before and during finishing suggests that limit feeding does not affect finishing gains when calves are limit-fed at the same rate they would have achieved on pasture. Feed efficiency during finishing was best for Treatment 1 calves, suggesting that calves limit-fed at low rates of gain can show compensatory gain.

Age at slaughter tended ($P<.06$) to be youngest for Treatment 3 calves that were full-fed from weaning to slaughter. Treatment 1 calves tended to be the oldest at slaughter. Days from initiation of the finishing phase to slaughter also tended to be lowest for Treatment 3. Contrary to popular belief, Treatment 3 calves full-fed high concentrate from an early age did not reach an equivalent level of fatness at lighter weight than calves grown more slowly.

Carcass traits are shown in Table 3. All groups were killed at similar

backfat thickness. Quality grade and marbling score were not increased by feeding high concentrate diets from an early age. Ribeye area, yield grade, KHP% and dressing percent were similar for all treatments. Lean maturity scores were greatest ($P < .01$) for Treatment 1. Skeletal and overall maturity scores also tended to be highest for Treatment 1. Differences in maturity scores probably reflect the greater age at slaughter of Treatment 1 calves.

In conclusion, fall-born calves can be successfully early weaned during the winter and grown efficiently to normal weaning age on limit-fed, high concentrate diets. Limit feeding apparently does not affect subsequent finishing performance when preweaning rate of gain is similar to that achieved on forage and milk. Feeding high concentrate diets from an early age may not, however, increase marbling when calves are slaughtered at about one year of age.